

Remarks/Arguments:

Claims 78-83 are pending in the application.
Claims 78-83 stand rejected.

Rejection of Claim 78 under 35 U.S.C. § 102

Claim 78 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Mizuuchi et al. (USPN 5,323,262). Applicants respectfully traverse.

Pending claim 78 recites "a step of forming a proton exchange layer ... a high temperature annealing step ... at a temperature of 150°C or higher, and a low temperature annealing step ... at a temperature of 120°C or lower for 1 hour".

As shown in figure 16 of the present application there are two annealing steps. The specification describes that the second (low temperature) annealing step is performed to mitigate an increase in refractive index, and if the temperature at which the low-temperature annealing is performed is below 200°C the strain can be greatly mitigated (see page 42, lines 2-10).

The Examiner asserts that these features are disclosed by Mizuuchi et al. The Examiner points to column 5, lines 37-39 and column 9, lines 61-64 of Mizuuchi as teaching the high temperature annealing step. However, the reference to column 5, lines 37-39 does not mention an annealing step and merely refers to the description of the figures. While column 9, lines 61-64 merely describes that the overall body of the substrate was inverted because the heat treatment temperature has exceeded the Currie point (and defines the Currie point as 604°C).

Regarding the low temperature annealing step the Examiner refers to column 3, lines 40-41 of Mizuuchi, which merely indicates that an annealing treatment is performed at a temperature lower than 550°C.

Mizuuchi does not describe the process of:

1. forming a proton exchange layer;
2. performing a high-temperature anneal; and
3. performing a low-temperature anneal.

Mizuuchi only describes performing a single anneal step after the proton exchange layer is formed (see abstract, or column 16, lines 46-49).

Therefore, applicants respectfully submit that claim 78 is not anticipated by Mizuuchi under 35 U.S.C. § 102(b) and the present rejection should be withdrawn.

Rejections of Claim 82 under 35 U.S.C. § 102

Claim 82 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Yamamoto et al. (USPN 5, 253, 259). Applicants respectfully traverse.

Response Dated January 30, 2006
Reply to Office Action of September 28, 2005

Pending claim 82 recites "a step of performing a proton exchange ... a first annealing step ... at a first temperature, after performing the proton exchange ... a second annealing step ... at a second temperature after performing the first heat treatment, wherein the second temperature is lower than the first temperature by 200°C or more".

The advantages of such a two stage annealing process are the same as those discussed for claim 78.

The Examiner asserts that the first annealing step is disclosed in column 1, lines 61-65 of Yamamoto. This section of Yamamoto is referring to the background section of Yamamoto and describes that domain inverted regions 3 in which the domains are inverted to the direction opposite to that of the LiNbO₃ substrate are formed by a heat treatment at a temperature of about 1100°C.

This does not describe a proton exchange process, and the heat treatment at 1100°C is a process of forming the domain inverted structures, not an annealing step, and therefore cannot be "a first annealing step ... at a first temperature, after performing the proton exchange" as recited in claim 82.

Regarding the second annealing step the Examiner refers to both the background section of Yamamoto (column 1, lines 65-68) and the actual detailed description of Yamamoto (column 5, lines 49-51). In these passages Yamamoto describes an annealing step at a temperature of 350°C for 3 hours (column 1 and column 5).

However, it is clear from column 5, lines 44-51, that Yamamoto only teaches proton exchange in a pyro-phosphoric acid at 230°C for 1 hour and then an annealing step (single) at a temperature of 350°C for 1 hour.

Yamamoto does not appear to describe a second annealing temperature.

The Examiner appears to consider that the first annealing step is the step performed at 1100°C. However, as described above this is not the case. The heat treatment at 1100°C is the process step for performing the domain inverted regions and NOT an annealing step performed after the proton exchange process.

Therefore, Yamamoto fails to teach or suggest:

1. performing a proton exchange process;
2. performing a high-temperature anneal after the proton exchange process; and
3. performing a low-temperature anneal, wherein the temperature of the low-temperature anneal is lower than the high-temperature anneal by 200°C.

Therefore, applicants respectfully submit that claim 82 is not anticipated by Yamamoto et al. under 35 U.S.C. § 102(b) and the present rejection based on this reference should be withdrawn.

Claim 82 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Nutt et al., "Simple Control of Ti-diffused LiNbO₃ waveguide Profile and Propagation Characteristics," *Electronics Letters*, Vol. 24, No. 1, 7 January 1988, p. 56-58.

Applicants respectfully traverse.

The Examiner appears to consider that the first annealing step occurs at 1000°C and the second annealing step occurs at 210°C based on the paragraph bridging page 56 and 57 of Nutt.

However, this is not correct. Nutt describes annealing at 1000°C for 12h in flowing wet oxygen and then performing proton exchange in benzoic acid at 210°C for 8 min and 4 min (see last paragraph of page 56). Therefore, the annealing step at 1100°C is not the same as the first annealing step of claim 82 since it is performed before the step of proton exchange.

Nutt then describes (after proton exchange) that the proton exchange surface layer is annealed at 350°C and/or 400°C in flowing oxygen for times from a few minutes to a few hours (see first paragraph on page 57).

Because of the "and/or" language Nutt could be describing two annealing steps, one at 350°C and one at 400°C. However, the second temperature is not lower than the first temperature by 200°C or more, and in fact the second temperature is higher than the first.

Therefore, Nutt at least fails to describe "wherein the second temperature is lower than the first temperature by 200°C or more" as recited in claim 82.

Therefore, applicants respectfully submit that claim 82 is not anticipated by Nutt et al. under 35 U.S.C. § 102(b) and the present rejection based on this reference should be withdrawn.

Therefore, applicants respectfully submit that all rejections of Claims 78 and 82 under 35 U.S.C. § 102 have been overcome.

Objection to Claims 79-81 and 83

On Page 4 of the Detailed Action, the Examiner states "Claims 79-81 and 83 are objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims."

Applicants wish to thank the Examiner for indicating that Claims 79-81 and 83 contain features which are allowable.

At the same time, Applicants respectfully submit that all rejections of independent claims 78 and 82 have been overcome by the arguments stated above, and that all references cited by the Examiner in the present Office Action fail to disclosure all the features of claim 78 and 82.

Claims 79 - 81 are properly dependent on Claim 78. Applicants therefore respectfully submit that Claims 79-81 are in condition for allowance.

Claim 83 is properly dependent on Claim 82. Applicants therefore respectfully submit that Claim 83 is in condition for allowance.

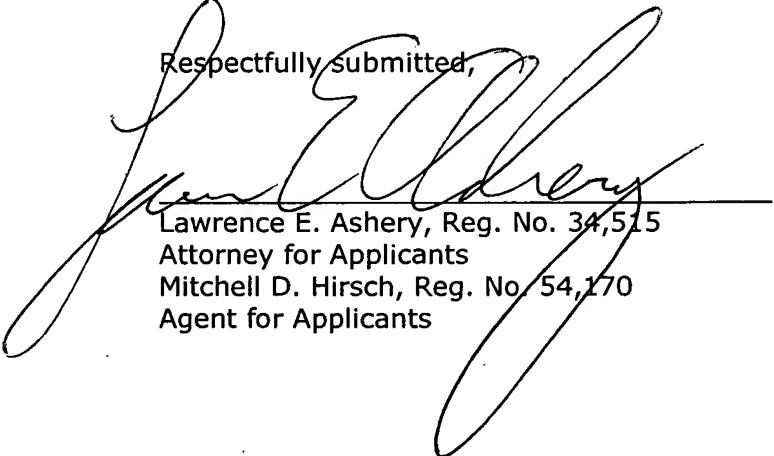
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Conclusion

Applicants respectfully submit that all rejections and objections to Claims 78-83 have been overcome and should be withdrawn and that Claim 78-83 are in condition for allowance.

Respectfully submitted,


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January 30, 2006
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